



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

## COLLEGE PREPARATION: WHAT IS ITS EFFECT ON WHAT YOU TEACH AND HOW YOU TEACH IT?

BY HARRY ENGLISH.

I have taken the liberty of treating this topic in a somewhat broader way than would appear at first sight to be intended, though it is far from my intention to avoid a direct answer to the obvious meaning. It is hoped however that nothing shall be construed to be other than an unprejudiced presentation of a few salient points for earnest consideration.

College preparation implies a response to college requirements which present in a tangible form the attitude as to prerequisite education and preparedness assumed by the college to be vitally necessary to accomplish the realization of its ideals as to true citizenship, right living and thinking, developed efficiency both individualistic and communistic, intellectual and material achievement, and high moral standards for the citizen unit and the governmental whole.

This attitude may be inflexible, but it is now more or less elastic, responsive partly to local environment, but more largely to country-wide or section-wide sentiments as to economic tendencies and all those agencies which tend to link up the activities of the individual in his home and community with those of the college as a true educational institution to aid the state and the individual to realize the common intellectual, moral social and civic ideals.

These same agencies are affecting most vitally the courses of study, subject matter, methods of instruction, and in fact the whole structure of the elementary schools which are most responsive to home and civic suggestions especially those of various Parent and School Associations which are very active partners in school administration, both elementary and high.

The high school as a continuation of the elementary school must immediately build upon it; as a college preparatory school

it must meet college requirements. The foundation work however is the same, and if it is changed radically and quickly without giving the high school opportunity to adjust itself to the new conditions and continue college preparation, then between the upper and the nether mill stones the high school is sorely pressed to accomplish its dual mission.

Changes in college requirements as to subjects other than mathematics may affect seriously what we teach and how we teach, as such changes frequently necessitate changes in the high-school courses of study, which now that Latin is somewhat suppressed, generally press hard upon the stability of the course in mathematics, not only as to subjects permitted to be taught, but as to methods of teaching. Mathematics, by sheer force of its intrinsic worth, must contend against those new subjects which have a unit value for college entrance, and because of their close association with civic and domestic life appeal forcibly to the pupil as well as the parent, and are capable of being taught in a most attractive and interesting manner with the aid of illustrated lectures, pageants, dramatization of parts of books, plays by the pupils, moving pictures, victrolas, musicals, addresses by prominent men, and kindred stimuli, which are in line with the natural desires of the pupil.

To teach by such methods the sterner realities contained in a worth-while course in mathematics, requiring a constant summing up and application of methods and knowledge acquired, is not possible, if indeed desirable.

They may be desirable adjuncts to the general development of the pupil, but when used to excess are of doubtful ultimate value tending to prevent the formation of the strong backbone of determination, concentration, power of doing and thinking, close and persistent application, and retention of ideas which so characterized the high-school pupil of some fifteen years ago, and which is so lacking at the present time of easy endeavor.

Then there was no such publicity of the sentiment that the sexes are equal in all endeavors, but it was never urged that the girl could not do the mathematics that the boy could. The girl merely took the opportunity to show that she could. Now however it is urged by many that some substitute for algebra and plane geometry must be provided for the girl, since she does

not need them, and that plane geometry be elective for all. This involves a contradiction of hypotheses unless the ultimate aim is to wipe out mathematics entirely. As yet no one has suggested that arithmetic be made elective for either boy or girl, but the suggestion is about due, if the study of arithmetic is disquietingly annoying to the pupil and something better suited to his material interests and natural tendencies can be substituted.

It is evident that high-school methods and topics in mathematics cannot be violently opposed to those of the elementary school, and yet they should adapt themselves to the mentality of the child so as to develop his mental fiber during the wonderfully important period of high-school life, and at the same time must prepare for college, coördinate with other high-school subjects so as not to violate sound principles of child psychology, hold the interest against the more popular and adaptable methods of so-called vital interest, which are more potent to affect methods of teaching mathematics than are college requirements as to stipulated amounts and potentiality.

The path of the teacher and of the pupil in mathematics could be made less hazardous and more attractive and interesting as well as profitable, if an elementary course in so-called observational geometry and mensuration backed up by systematic training in mental arithmetic and followed by a first half-year of algebra were taught in the elementary schools. The discussion as to college requirements in all of its ramifications would then cease, if the present scheme of high-school mathematics is retained, providing that the first two years be required; the last two elective. The field of work would then present any number of possibilities for betterment and mutual aid and at the same time prepare for college.

The first year would complete the required elementary algebra, prepare properly for the problem work of plane geometry by giving the necessary knowledge and power as to handling radicals and quadratics, would help the physics of the second or succeeding years by giving the pupil a knowledge of proportion, and practical measurements, transformation of formulas, an understanding of principles and things and a real power of abstraction. The pupil in the elementary school has the ability to accomplish what is suggested if he is given the opportunity,

and will thereby acquire a power earlier in his school career which will be ready when he needs it most, and without which he is greatly hampered if he goes into the high school, and uncomfortably satisfied if he does not.

The third year could begin with solid geometry, followed by plane trigonometry with direct application to practical surveying with instruments and plotting of surveying problems if desired.

The fourth year could then be used for a review of elementary algebra followed by advanced algebra and a general review of mathematics or a brief course in the elements of conic sections.

Numerous other possibilities suggest themselves.

The present tendency towards a six-year elementary school, followed by a six-year high school will if realized present an admirable solution of present difficulties, if superintendents and high-school principals can be made to see the situation as I see it. If we desire this we should try to accomplish it.

For about thirty years Washington did have such a high-school course in mathematics, preceded by a strong algebra course in the eighth grade. Geometry was always taught from the reasoning standpoint and hundreds of original exercises were worked during each year. Fourth-year pupils easily completed, fifteen years ago, the Cornell requirements in advanced algebra which were far in excess of the present ones, and in addition studied conics, covering the straight line and circle exhaustively and the other conics comparatively, each pupil making a table of analogous formulas.

This formed largely a summary and a review of mathematics.

College requirements did not then affect us either as to scope or methods, but merely prescribed certain topics to be studied by the pupil in order to force him to obtain the knowledge and mental fiber and power necessary for effective progress and development however much he might prefer to slide through by means of a lot of electives (now vastly increased in number) which he merely desired but had no ability to choose.

The four years then were far more productive, with much less wasteful effort on the part of the teacher. The attitude of pupil towards work was more virile. There was no complaint of lack of mentality or ability to do much and do it thoroughly and continuously. There was no sapping of inherent strength.

The reverse is true now though both our teachers and textbooks are supposed to be better.

Now, even the teachers of the new vital-interest subjects seem discouraged as to the mental grasp and attitude of their pupils towards work, and must exert themselves more and more to keep the pupils up to a standard of scholarship which seems to be falling. It would seem that the general tendency towards insisting so much upon developing the pupil, by always keeping in touch with his environment, has not accomplished all that is urged for it and that either the touch is artificial or the environment unreal.

Undoubtedly, forces not well understood are at work to do away with the strength of the old order of things while the external appearance seems to be more effulgent and impressive than before.

There is a panic in the educational world and a run has been started on one of its oldest, greatest and strongest institutions, one which from the very beginning, more than any other, has been the greatest stabilizer of educational currency. Rumors are being circulated as to the soundness of the institution and its methods of administration. It is accused of unrighteous monopolistic tendencies and it is urged that it be closed up. Let the sponsors of this movement, however well-intentioned they may be, pause and think. It may be that the Mathematical Bank, unaided, will finally come down with a crash which will cause such further demoralization as to result in the failure of those new institutions which they are trying to make solid.

It is not at all certain that they are clear as to the real place, actual or relative, in the scheme of education which their specialty occupies, or as to its ultimate effect and influence.

Even the lowly mathematician feels more certain in these respects as to his specialty.

It is undoubtedly true however that though the colleges have modified their requirements by permitting under certain restrictions unit values to certain new subjects, they have, in all of this turmoil of thought, standardized amounts required in various subjects, and thus put a definite stamp of value on educational work, without which the high-school teacher of any subject, left solely to himself, would have been utterly at sea, overwhelmed by the conflict of ideas around him.

For this standardization of educational coins, the high-school teacher should be truly grateful, however he may object to the too little or too much elasticity of circulation permitted.

Co-existent with, if not resultant from, the tendency towards the so-called humanizing of high-school courses and subjects have come a great latitude in the choice of high-school electives and much slower and far less accentuated changes in college courses and requirements.

The changes in requirements have been in subjects as well as in amounts, the latter being lessened actually, or virtually by increasing the number of required high-school periods, the whole being then expressed in terms of units.

The unity of courses became a thing of the past; emphasis was placed upon unit values of unrelated subjects and a tremendous impetus was given to the tendency towards subject promotions. In many cases, unrelated subjects were taken during the last two years in order to make up the number of credits necessary for graduation or college entrance, while at all times it was possible to make up failures of previous years. The disintegration continued until finally, in many cases, there was no longer a class, but a mere composite of the various degrees of intellectuality possessed by pupils of as many as four different school years. Manifestly the method of teaching such aggregations varies greatly from that of teaching a class composed of pupils of the same high-school year with a unity of interest and common endeavor, but this could hardly be attributed either to college requirements or to the scheme used to express them.

The college situation and the high-school situation are both merely responses to the great present-day tendency to treat the pupil as an individual with individual tendencies and not as one of co-ordinate members of the same group; and to minimize to the utmost the class and the institution as such.

Whether this is the wisest policy remains to be seen. The college requirements are surely not to blame; on the contrary, though they may influence what we teach, they are most potent aids to the teachers of high-school mathematics and we would do well to combine forces with our friends in the colleges to consider how best to meet the rising tide of opposition to the continuance of algebra and geometry as required subjects in the

high-school curriculum; an opposition which high-school principals and school superintendents do not seem over enthusiastic to meet. Afterwards we can adjust our differences if any then exist. At present our work is cut out for us and there is no time to waste on non-essentials.

It seems to me quite evident that the general college custom of admitting by certificate leaves the high-school teacher singularly free as to methods of teaching so long as the pupils entering college possess the requisite knowledge, the ability to do and the desire to do, which are demanded by the colleges. Of course there remains the necessity of preparing for the examinations set by the College Entrance Board and by those colleges which do not grant certificate privileges. These examinations are not unreasonable and differ markedly from those set for admission to West Point and Annapolis, which require the special training given by the special coaching schools which prepare for those institutions.

We however are concerned mainly with the question of time and subject limits required by colleges, and it is in the most friendly spirit that I offer the following observations:

#### I. AS TO PLANE GEOMETRY.

It has always seemed unfortunate to me that the number of recitations per week in this subject was increased from four to five in order to obtain a credit of one unit, with a penalty of reduction in the unit credit for less than five periods per week. This seems to me to put a premium upon the wastage of time, as it was quite possible in the previous years to cover most effectively the entire subject of plane geometry with four periods per week. The added period has resulted either in the introduction of enervating material or a spreading out of the original material over an unnecessary amount of time. In either case the resultant was a greatly impaired efficiency in the use of time not only for plane geometry but for other subjects.

There is too much wastage of time and impaired efficiency in schools as it is and both of these habit-forming educational drugs should be promptly eradicated.

The proper and most effective method of employing time is of



most vital importance in obtaining the best pupil-product and teacher-product, and the scientific study of the most effective use of the recitation period is much needed during these days of boasted scientific, economic and concentrated efficiency. An educational discriminant is needed to get at the root of the matter.

Too much pocket money allowance tends to produce material extravagance; too much time allowance tends to produce educational extravagance.

It may be however that the colleges have recognized that the pupils cannot now do the work in four periods per week, probably because of the intensity of outside distractions, recognized school social life, various societies, athletics, shortening of recitation periods, irregularities of pupils' programs and the many other kindred new developments of recent years. If this is the case the colleges have merely recognized a situation and met it. Otherwise they are somewhat responsible for a lessened high-school educational output, both as to quantity and quality as well as potential efficiency.

Be this as it may there seems to be a vicious circle from which no one seems desirous to escape.

## II. AS TO ALGEBRA.

Some time ago I made a summary of these requirements as set forth in the catalogues of ten colleges representing varied activities. The following observations suggested themselves:

### *A. Elementary Algebra.*

1. The practise of designating one unit for algebra to quadratics, and one half unit for quadratics and beyond is not uniform. In some cases  $1\frac{1}{2}$  units are designated for elementary algebra, though the sum total of topics required is not coextensive with the combined total as separately expressed by other colleges. In one case one half unit is given for a group of topics, composed of topics selected from those usually given under elementary algebra, and additional topics.

2. Although in the main the designations of various topics were practically the same, the differences were sufficient to admit of different interpretations.

3. Numerous particular things insisted upon by some colleges are omitted or taken for granted by others.

In other cases the differences were specially emphasized or broad topics given without particularizations.

I give some examples:

- (a) H. C. F. by factoring only and solution of equations by factoring (no L. C. M.) *or* H. C. F. and L. C. M. unqualified *or* H. C. F. and L. C. M. by factoring.
- (b) Linear equations unqualified; omitted; with particularizations.
- (c) Extraction of roots unqualified; square root only, equations involving radicals; extraction of roots particularized.
- (d) Quadratics unqualified; quadratics particularized.
- (e) Problems depending on; omitted.
- (f) Progressions qualified; unqualified.
- (g) Binomial theorem, proof omitted; binomial theorem unqualified.
- (h) Graphic method (one college only).
- (i) Negative quantities and interpreting negative results (one college only).
- (k) Concrete examples from physics, commercial life (two colleges).
- (l) Other similar cases.

### *B. Advanced Algebra.*

- 1. Same designations are not used to denote same topics.
- 2. One college requires a number of topics not required by any other and omits some not required by them.
- 3. A second college requires a number of topics not required by any other and omits all required by the others.
- 4. One college requires simple problems of choice and chance, others require simple cases of permutations and combinations, or merely permutations and combinations.
- 5. One college at least requires graphical representation of division and multiplication of complex numbers.
- 6. One college specifies omission of multiplication theorem in determinants. Others are silent.
- 7. One college requires theory of equations unqualified. Others go into details more or less specific.

8. Many colleges expressly require various specific things not of a topical nature.

#### CONCLUSIONS.

1. It would seem advisable for all colleges to agree to use the same language or term to designate the same thing and if possible to agree upon the same set of topics classified under exactly the same main divisions of elementary algebra and advanced algebra.

2. Special diverging desires as to ability and particular features of algebraic work could be more simply expressed and the method of expression so standardized as not to lead the pupil to feel that various colleges want various kinds of mathematical ability, because of different language employed. This standardization of requirements as far as possible into identical language statements would remove much petty annoyance, as fundamentally for the most part colleges desire the same thing.

3. *As to Advanced Algebra.*—The minimum requirements present a set of somewhat detached fragmentary elements very difficult to teach developmentally. Many topics have been omitted that were in previous requirements and which would seem to be necessary for college work and which at the same time would furnish links to a broad knowledge of the power of algebraic thought and would permit of a sustained method of teaching and the acquisition of a power of conclusive action thereafter. Advanced algebra at its best seems to be a training in the use of tools, but the process of training could be a more coherent and sequential one. Again it is urged that a standardization of topic designations and topics selected be made, as it is part of our duty in Washington to provide for many colleges, and between them all, they stretch over a vast territory in advanced algebra. Here only are we greatly affected as to methods and topics.

Washington occupies a unique position. It is legislated for by the Congress of the United States, even to minute details.

Indeed there is a congressional provision, which so far as I know has never been repealed which is to the effect that the Washington high schools shall provide instruction sufficient to prepare for admission to Harvard College.

Our high schools are also unique in that they have a population of the most diversified kind which may be divided roughly into two groups:

- (a) *The Fluctuating*: Composed of children of Senators, Representatives, army and navy officers, government officials, foreigners connected with the diplomatic corps, and other temporary residents.
- (b) *The Permanent*: Composed of children of government clerks, business men, and other permanent residents.

The high schools of Washington have a population proportionally as large as that of any other city. The same is true of our graduates who enter college and the number of different colleges entered is very great.

Usually a city high school prepares mainly for some one college. Our graduates in the main either have very recently come to our high schools from other cities or are children of parents who have come to us in former years and naturally are to go to those colleges in which the parents are more or less interested. It is most difficult to provide suitable high-school instruction for those who come to us in all stages of preparedness as high schools differ materially in arrangement of courses and traditions.

It is still more difficult to prepare for numerous different colleges, if they differ even slightly in requirements. Heretofore this matter has been adjusted without much hardship. However, three years ago, after a continuance of thirty years, algebra was dropped from the eighth grades and immediately there arose the serious problem of radically readjusting the high-school course in mathematics. At present it seems that the course must be much twisted because of the pressure which presumably forced algebra out of the eighth grades and presumably is due to the desire to prepare for life by adjustment to environment as viewed by the scientific social worker and those who have special views as to the co-ordination of home, school and city life.

This crisis comes at a time when we must prepare for many more colleges than is usually the case, and is made more acute because with few exceptions our high-school classes are mixed classes. Confronted by the growing tendency to make geometry

and algebra elective for girls and it may be, geometry elective for boys, the prospect of readjusting our course is not inviting, and any stabilizing of the requirements in algebra, especially advanced algebra, will be gladly welcomed by the Washington high-school teacher of mathematics. For the first time we are seriously troubled as to what to teach and how to teach, but college preparation as responsive to college requirements is merely incidental. The difficulties, ever increasing, are of a different character, and it behooves us all to come to the defense of the educational right of mathematics to live and fulfill its manifest destiny as the rock foundation of educational truths and endeavors.

WASHINGTON, D. C.